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January 27, 2000

(File No.) 021992-0010

BY HAND DELIVERY

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Re: **DIRECTV Report; File No. 0094-EX-ST-1999; ET Docket No. 98-206; DA 99-494; EX PARTE**

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Dear Chairman Kennard and Commissioners:

DIRECTV is concerned that the Commission is being buffeted by contradictory policy cross-currents as it considers dramatic regulatory actions that will affect the future of the Direct Broadcast Satellite ("DBS") industry in the United States.

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On the one hand, the Commission appears to be doing its utmost to recognize and continue facilitating the development of DBS as a cable-competitive service. Thus, in its most recent report to Congress on the status of competition among multichannel video programming distributors ("MVPDs"), the Commission has recognized that although the cable industry continues to serve a dominant 82% share of the MVPD market,[1] the growth in noncable MVPD subscribership is being driven by the DBS industry,[2] which has emerged as the cable industry's most formidable competitor.[3] Furthermore, the Commission in that report noted the positive effect that the recent Congressional amendment to the Satellite Home Viewer Act ("SHVA") will have for consumers, who will for the first time be able to receive local broadcast signals on their DBS systems, thus ensuring near-complete substitutability between DBS and cable as MVPD competitors. Indeed, the Commission has expressed the hope that the revised statute will "have a significant and positive effect on MVPD competition," reiterating its belief that "increased competition is the best way to keep cable rates reasonable and in check," and stating its determination to "aggressively implement the new SHVA in order to facilitate consumer choice in the MVPD marketplace."[4]

On the other hand, while the Commission's MVPD Competition Report correctly acknowledges the high quality of DBS service as a major competitive distinction between DBS and cable,[5] *the Commission has proceeded to entertain proposals that threaten to radically undermine the quality of DBS service, and that pose a real and substantial threat to the continued development and growth of DBS as a cable-competitive service.*

Specifically, as you know, Northpoint Technology, Ltd., along with its affiliated companies Diversified Communication Engineering, Inc. and a number of entities operating under the name of "Broadwave" (collectively "Northpoint") has proposed to introduce a secondary terrestrial service into the 12 GHz band, which is the primary, "mission critical" frequency band used by DBS operators. Based upon recent demonstrations of its technology in the Washington, DC area conducted over the summer and fall of 1999, the purported results of which are summarized in a Progress Report submitted to the Commission this past October,[6] Northpoint claims that its system and architecture showed "no impact to DBS," and urges the

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1 *Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming*, CS Docket No. 99-230 (rel. Jan. 14, 2000) ("MVPD Competition Report"), at ¶ 5.

2 *Id.* at ¶ 8.

3 *Id.* at ¶ 70.

4 *Id.* at ¶ 14.

5 *Id.* at ¶ 71.

6 Progress Report WA2XMY, Northpoint-DBS Compatability Tests, Washington, DC (Oct. 1999) ("Northpoint Progress Report").

Commission to agree that "Northpoint is a viable technology and ready for deployment through the United States."[7]

As the Commission well knows, the U.S. DBS industry emphatically disagrees with this assertion. The nation's DBS operators and other interested parties have already submitted on the record detailed technical objections to Northpoint's proposed operations in the 12 GHz band.[8] However, given Northpoint's extravagant claims regarding the ability of its terrestrial systems to coexist in the DBS downlink band with no harmful impact on DBS subscribers, DIRECTV has prepared the enclosed extensive report, "Conclusions to Date Regarding Harmful Interference From a Proposed Northpoint Technology Terrestrial System Operating in the DBS Downlink Band, 12.2-12.7 GHz," for submission in the above-referenced matters.

The enclosed report analyzes carefully and completely the results of the Northpoint Washington, D.C. tests. It also documents tests performed by DIRECTV in Spring Creek, New York, which show conclusively the interference effects of Northpoint technology on DBS transmissions, *based upon data from Northpoint's own demonstrations*. The report also documents the work of Radio Dynamics, a respected Bethesda, Maryland-based engineering consulting firm, which worked for months with DIRECTV to generate predicted interference zones surrounding Northpoint transmitter sites, and performed propagation analyses of both the coverage areas and interference zones of Northpoint transmissions based on publicly available data. Overall, the enclosed report shows how, based on the Northpoint D.C. test results, the Northpoint system poses a grave interference threat to U.S. DBS subscribers' receipt of service. In the process, the report:

- describes the ways in which Northpoint interference manifests itself relative to DBS operations;
- provides new test data, extrapolated from observations of the Northpoint D.C. tests, that demonstrate the effect of Northpoint interference on the rain performance of DBS receiving equipment;
- reiterates the interference requirements of the DBS industry under rain fades;

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7 *Id.* at 27.

8 *See, e.g., Application of DIRECTV, Inc. For Expedited Review and Request for Immediate Suspension of Testing, In the Matter of Diversified Communication Engineering, Inc., Experimental Special Temporary Authorization,* File No. 0094-EX-ST-1999, Call Sign WA2XMY (June 25, 1999); *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency, with GSO and Terrestrial Systems in the Ku-band Frequency Range, ET Docket No. 98-206,* Comments of DIRECTV, Inc. (filed Mar. 2, 1999); Reply Comments of DIRECTV (filed Apr. 14, 1999); *see also Comments of Pegasus Communications Corporation,* ET Docket No. 98-206 (Dec. 29, 1999); *EchoStar Preliminary Report on the Impact of Northpoint on the Direct Broadcast Satellite Service Based Upon Testing Performed to Date* (Oct. 29, 1999).

- provides a comprehensive analysis of predicted interference to all U.S. BSS orbital assignments from Northpoint transmissions;
- shows how these predictions compare with field measurements; and
- concludes that Northpoint has not established a technical basis for its claimed ability to co-exist with the DBS service, even on a secondary basis, and suggests that any future Northpoint demonstrations be designed to reflect typical and worst case transmitter sitings, not only best case, atypical situations.

Northpoint to date has proffered highly questionable, politicized exercises in selective data collection as "conclusive" evidence of the ability of its technology to operate at 12 GHz without interfering with DBS operations.[9] The attached report and detailed analysis, along with tests that the DBS providers themselves will soon conduct,[10] will facilitate the joining of issues at a meaningful technical level.

Furthermore, DIRECTV hopes that the quality of the analysis in the attached report will underscore the magnitude and legitimacy of DIRECTV's concern in this matter. Northpoint has in the past accused the DBS industry of "dilatory tactics" because, it is alleged, DBS operators fear Northpoint as a potential competitor.[11] That claim is nonsense.

The record clearly reflects that, although the Northpoint business plan has continually changed over time, DIRECTV has consistently opposed the introduction of Northpoint technology at 12 GHz -- *even* when it was being touted by Northpoint as a "complementary" rather than competitive service to DBS operations, as a means of offering local television signals to DBS subscribers.[12] The DBS industry has *never* made an effort to forestall competition from terrestrial services – for example, when the Commission proposed the allocation of substantial

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9 Northpoint Progress Report at 27.

10 *In the Matter of Request for Special Temporary Authorization to test for 120 days the interference caused to typical Direct Broadcast Satellite receivers from the system proposed by Diversified Communications Engineering, Inc. in the 12.2 – 12.7 GHz band*, File No. 0418-EX-ST-1999 (filed Dec. 11. 1999) (pending).

11 *See* Northpoint STA Opposition (Dec. 21. 1999), at 4.

12 *See, e.g., Northpoint Changes Local Plans,* Satellite Business News Fax Update (Aug. 27, 1999) (quoting Northpoint's president, and noting that while Northpoint had previously planned to offer a standalone package of local channels to complement DBS service, its business plan would now change to become a DBS alternative); *In the Matter of Northpoint Technology, Petition for Rulemaking to Modify Section 101.147(p) of the Commission's Rules To Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band By Digital Broadcast Satellite Licensees and Their Affiliates*, RM No. 9245, Opposition of DIRECTV, Inc. (April 20, 1998) (opposing Northpoint rulemaking proposal to operate in the 12 GHz band as a complement to DBS service).

spectrum to Location Multipoint Distribition Service ("LMDS") or to allow digital Multipoint Distribution Service ("MDS"). Here, DIRECTV's concern with Northpoint is not competition, but rather, is purely one of electromagnetic interference. DIRECTV worked with the Commission years ago, when DBS was a fledgling service, to ensure that secondary terrestrial microwave users were transitioned out of the DBS downlink band, and the Commission recognized at that time the interference threat such systems posed to DBS subscribers' receipt of service.[13] DIRECTV wishes the Commission to understand that today, as DBS has become a tremendously successful, mass-market consumer alternative to cable television, the interference threat posed by Northpoint technology, which is also proposed to be deployed on a mass-market consumer basis, is greater by *orders of magnitude.*

Finally, DIRECTV wishes to reiterate that Northpoint has made a choice in choosing to proceed as it has to date. Rather than acquire spectrum that was expressly allocated for the types of terrestrial wireless services that it proposes, such as LMDS, MDS or DEMS, Northpoint instead has decided to attempt to avoid paying for such licenses, either in the aftermarket or at auction, by seeking authorization to operate on a secondary basis at 12 GHz. And Northpoint's decision has certain consequences, not the least of which is the fact that the 12 GHz band happens to be the primary, mission-critical frequency band used by DBS operators -- a ubiquitous mass-market consumer service, deployed on a nationwide basis after billions of dollars of investment by the DBS operators, that today is offering tremendous benefits to American consumers in the form of competition to incumbent cable television operators.

The success of the DBS industry and the commitment it has made to its consumers demands that the Commission proceed with extreme care in evaluating Northpoint's technical puffery. By way of comparison, the DBS industry has spent several years working through the ITU process and with the Commission to determine whether co-existence between non-geostationary satellite orbit ("NGSO") systems and DBS systems is possible at 12 GHz. Whatever the ultimate outcome of that process, which is still ongoing, the debate has been open, detailed and technically rigorous. By contrast, Northpoint has not come close to offering that type of effort or detailed analysis.

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13 *See, e.g.*, Public Notice, *Initiation of Direct Broadcast Satellite Service -- Effect on 12 GHz Terrestrial Point-to-Point Licensees in the Private Operational Fixed Service*, 10 FCC Rcd 1211 (1994) (explicitly reminding remaining 12 GHz terrestrial licensees of their secondary status, and stating that "[i]n view of the imminent arrival of DBS service, terrestrial 12 GHz licensees should again consider relocating their operations to other available frequency bands or alternative facilities").

As the attached report concludes, Northpoint technology cannot be authorized at 12 GHz in any fashion unless the Commission can conclude with certainty that Northpoint's proposed terrestrial fixed service will not cause harmful interference to DBS operations. Under the most charitable view of the tests conducted by Northpoint, the Commission does not have a record before it that can remotely support such a conclusion.

Respectfully submitted,

Gary M. Epstein
James H. Barker
of LATHAM & WATKINS

Enclosure

cc: Attached Service List

Conclusions to Date Regarding Harmful Interference From a Proposed Northpoint Technology Terrestrial System Operating in the DBS Downlink Band, 12.2-12.7 GHz

DIRECTV, Inc.
January 27, 2000

TABLE OF CONTENTS

1 *Introduction*

DIRECTV, Inc. ("DIRECTV") has spent significant effort and expense during the past six months analyzing the proposal of Northpoint Technology, Ltd. ("Northpoint") to introduce, on a nationwide basis, terrestrial wireless operations into the 12.2-12.7 GHz band, which is the "mission critical" frequency band used by Direct Broadcast Satellite ("DBS")[1] operators in the United States to downlink digital programming to U.S. consumers. Through a series of test demonstrations in the Washington, D.C. area run in the summer and fall of 1999, Northpoint now claims to have proffered sufficient evidence for the Commission to proceed in accommodating its experimental, terrestrially-based wireless technology, which would re-use the 12.2-12.7 GHz frequencies, on a secondary basis, in a manner that Northpoint claims would be effectively interference-free relative to DBS operations in the band.[2]

DIRECTV has prepared this report to analyze the results of the Northpoint Washington, D.C. tests, and more generally, to show how, based on those test results, the Northpoint system poses a grave interference threat to U.S. DBS subscribers' receipt of service. The report concentrates on the following technical issues and provides the following information:

- describes the ways in which Northpoint interference manifests itself relative to DBS operations;
- provides new test data, extrapolated from observations from the Northpoint D.C. tests, that demonstrate the effect of Northpoint interference on the rain performance of DBS receiving equipment;
- reiterates, under rain fades the interference requirements of the DBS industry;
- provides a comprehensive analysis of predicted interference on all U.S. BSS orbital assignments from Northpoint transmissions;
- shows how these predictions compare with field measurements; and
- concludes that Northpoint has not established a technical basis for its claimed ability to co-exist with the DBS service, even on a secondary basis, and suggests that any future Northpoint demonstrations be designed to reflect typical and worst case transmitter sitings, not only best case, atypical situations.

---

[1] DBS is known internationally as Broadcasting Satellite Service ("BSS"), and the terms are used herein interchangeably.

[2] Progress Report WA2XMY, Northpoint-DBS Compatability Tests, Washington, D.C. (Oct. 1999) ("Northpoint Experimental D.C. Report"), at 27.

2 *Overview of Critical Issues Regarding Interference From a Proposed Northpoint System*

The Commission already has received various filings[3] providing technical analyses that document the harmful interference a Northpoint system will cause to DBS service in the United States. It is clear that the use of the 12.2 GHz – 12.7 GHz band by secondary users raise extremely serious concerns for DBS operators. The following discussion outlines critical issues that the Commission must take into consideration regarding the proposed deployment of Northpoint's system.

2.1 *Interference Will Degrade DBS Signal Quality and Service*

Interference received from either terrestrial based transmission systems (such as the proposed Northpoint system) or from space based transmission systems (such as from non-geosynchronous orbit ("NGSO") FSS operations) will clearly degrade DBS received carrier quality. This fact has been established by both analytical methods and by field tests. This fact also has been accepted by the International Telecommunications Union ("ITU") in its technical deliberations on NGSO-FSS sharing issues.

Interfering noise from the types of sources listed above will result in an increase in the operational noise floor of a BSS receiver and directly affect the quality of service. The impact of this noise can manifest itself in two ways;

a) a complete loss of reception under clear-sky conditions; and/or
b) reduced availability of the signal under rain conditions.

The case of a complete loss of reception is the most obviously unacceptable interference scenario because it immediately eliminates DBS as a viable competitor to cable television. However, cases with reduced availability performance are equally serious. Both of these situations are touched upon below. A more detailed discussion of the effect of Northpoint interference on availability performance is presented in Section 3.

[3] *See, e.g., Application of DIRECTV, Inc. For Expedited Review and Request for Immediate Suspension of Testing, In the Matter of Diversified Communication Engineering, Inc., Experimental Special Temporary Authorization*, File No. 0094-EX-ST-1999, Call Sign WA2XMY (June 25, 1999); *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO-FSS Systems Co-Frequency, with GSO and Terrestrial Systems in the Ku-band Frequency Range, ET Docket No. 98-206*, Comments of DIRECTV, Inc. (filed Mar. 2, 1999); Reply Comments of DIRECTV (filed Apr. 14, 1999); *see also Comments of Pegasus Communications Corporation*, ET Docket No. 98-206 (Dec. 29, 1999); *EchoStar Preliminary Report on the Impact of Northpoint on the Direct Broadcast Satellite Service Based Upon Testing Performed to Date* (Oct. 29, 1999).

2.1.1 Complete Loss of Reception is Clearly Unacceptable

It is undisputed that if a Northpoint system were deployed in the DBS downlink band, there would be a number of areas surrounding *each* Northpoint terrestrial transmitter where interference levels would prevent *entirely* the reception of DBS signals. Northpoint defines these areas as "Mitigation Zones," identified as areas where site shielding would be required to mitigate the interference problem.[4] However, from the standpoint of DBS system design, such site shielding runs directly counter to the viability of DBS operations, and cannot be allowed for business and competitive reasons.[5]

"Consumer friendly" operation is fundamental to a successful BSS. DBS providers have made a tremendous effort, and spent hundreds of millions of dollars, to simplify the operation of DBS receive terminals – for example, by introducing small antennas, using circular polarization, designing home receiving equipment to be easily self-installed, and so on. The existence of a significant number of mitigation zones, regardless of size, would create significant negative publicity and place an unacceptable mitigation burden on DBS customers that simply was not intended when the 12 GHz band was allocated for primary DBS operations. The very existence of these numerous mitigation zones – which Northpoint admits will cause "harmful interference to DBS reception" – would demand that special treatment be provided on an installation-by-installation basis to ensure high quality service to all DBS users. For those installations located within the mitigation zone, costly shielding would be needed to reduce interference to acceptable levels. This added complexity runs directly counter to the ubiquitous nature of DBS. All DBS customers have a right to interference-free reception of DBS signals, and the right to self-install and operate their own equipment without the complication of costly add-ons to "mitigate" such interference.

Further testing of the areas close-in to a Northpoint transmitter is needed to properly characterize the size of the mitigation zone around each such transmitter. For the Washington, D.C. demonstration, the area immediately around the transmitter was difficult to access because of numerous buildings, structures and foliage. These objects either blocked the Northpoint signal (from both a reception and an interference point of view), or prevented access to desired test sites. Any further testing should place the transmitter at a typical height in an open and unpopulated area to allow full characterization of the near-in regions to accurately determine the size of the mitigation zone.

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[4] *See* Progress Report WA2XMY, Northpoint -DBS Compatibility Tests, Austin, TX (Dec. 1998), at 5; *see also* Progress Report WA2XMY (Jan. 8. 1998) (acknowledging existence of exclusion zones around terrestrial Northpoint transmitters that will cause "harmful interference to DBS reception").

[5] Note also that Northpoint users would not require shielding from DBS transmissions.

2.1.2 Degradation of DBS System Performance

Apart from a complete loss of DBS signal reception in the mitigation zone around each Northpoint transmitter, the second manifestation of Northpoint interference is loss of DBS system availability performance. To clearly establish this manifestation as an observable fact, DIRECTV set up a controlled test of the phenomenon in Spring Creek, New York. In this recent test, two identical satellite receivers were fed a live DBS signal from a common antenna. One receiver, however, was injected with an extra fixed amount of noise from a noise generator, simulating interference from either a Northpoint system or, equivalently, an NGSO-FSS system.

Two interference test cases were run. In the first test case, a sufficiently high amount of noise was added to clearly establish the interference phenomenon. For the second test case, an amount of interference close to that measured at the Ericsson Memorial/Polo Field site (Washington, D.C. Demonstration) was used. The primary results were as follows:

1. During a significant rain event during the first test, the receiver with added interference experienced 90 minutes of outage, while the interference-free receiver experienced only 13 minutes of outage.

2. During a significant rain event during the second test, the receiver with added interference experienced 1 minute 40 seconds of outage, while the interference-free receiver experienced no outage.

The Spring Creeks tests unequivocally demonstrate the harmful interference effect that Northpoint-like interference has on DBS system availability during rain. When interference is added, a BSS receiver suffers more frequent and longer rain outages. The increase in outage time depends critically on the level of external interference. Details of the Spring Creek tests are presented in Section 3.4 below.[6]

2.1.3 ITU Accepted Protection Criterion Limits DBS Unavailability Degradation

Limits on signal availability degradation and restrictions on signal loss under clear-sky conditions have been accepted by the ITU as valid protection criteria for GSO BSS services.

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[6] As a side note, the purported conclusions on the impact of Hurricane Floyd on the Washington demonstration are based on very unscientific measurements and observations. The test technique failed to have a control receiver not subject to interference that could have served as a reference. Furthermore, the location chosen by Northpoint for these rain observations exhibited almost no interference, making any observations of the effect of interference on unavailability meaningless. Further discussion on this topic can be found in Section 3.4.2.

It is noted that availability protection is usually expressed as a limit on the degradation allowed in unavailability performance, which is the inverse of availability performance.

In particular, the United States has agreed in ITU forums to move forward with regulatory interference limits on the operation of NGSO-FSS systems in the BSS bands. These limits are based primarily on criteria that (1) limit the increase of BSS operational unavailability caused by interference from all non-GSO FSS systems to a maximum of 10%, and (2) protect BSS reception under clear-sky conditions. These newly developed criteria are the result of two years of intense work in the international regulatory arena.

If interference generated by a Northpoint system is noise-like (that is, low-level wide-band QPSK digital modulation that appears as noise to the demodulator in a BSS receiver), the BSS receiver cannot distinguish between non-GSO FSS interference and Northpoint interference. The effects of interference from both sources will lead to reduced BSS system performance via the same means -- that is, by increasing the BSS receiver noise.[7] Under these conditions it is essential that the criteria developed for NGSO-FSS interference be applied to Northpoint, and that the total increase in BSS system unavailability *from all sources* be -- at most --10%. The ITU interference criterion that should be applied to Northpoint is discussed in more detail in Section 4 below.

2.1.4 Washington, D.C. Field Observations Confirm DBS Signal Degradation

DIRECTV made a significant effort to observe interference into DBS receivers during the Washington, D.C. demonstration. The observations concentrated on two specific geographic locations relative to the Northpoint transmitter that DIRECTV predicted would be especially vulnerable to Northpoint transmissions.

As explained below and in more detail in Section 5, measurements made in these two areas confirm interference levels that are well above the levels allowed for NGSO-FSS systems.

2.1.4.1 Predicted Interference Geometries

DIRECTV predicted areas of high interference by analyzing the horizon gain characteristics of a typical DBS receive antenna, the planned boresight and

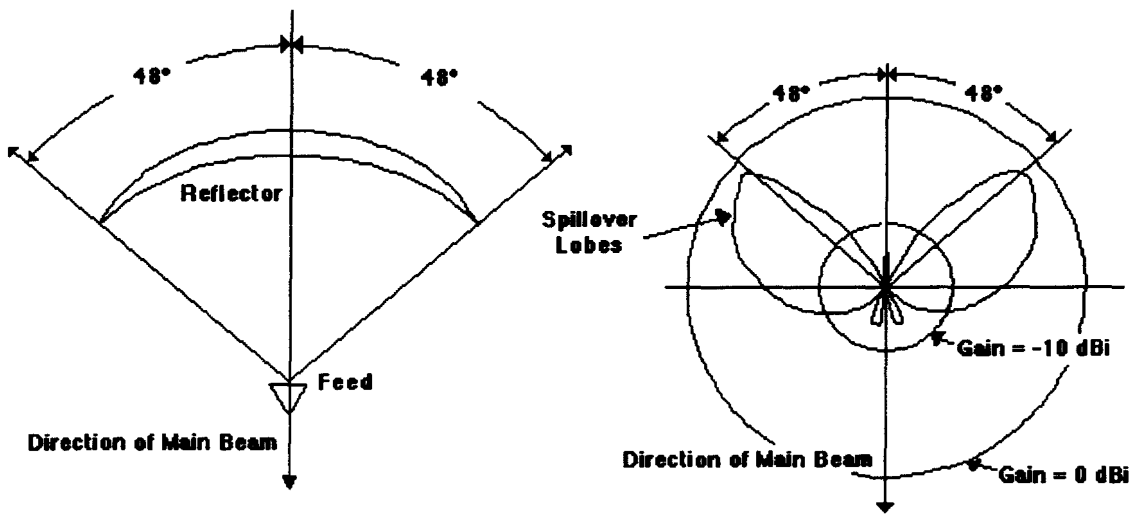
[7] As described in document 10-11S/156, a contribution to JWP 10-11S prepared by DIRECTV, the interfering signal can be treated as white gaussian noise if it is sufficiently uncorrelated with the desired signal. However, in cases in which the desired and interfering signal are somewhat correlated, as in the case when the interfering signal is of the same modulation type as the desired signal, it is believed that the degradation may be more severe than suggested by using a white gaussian noise assumption.

pattern of the Northpoint transmit antenna, and the locations of currently active DBS satellites.

To understand how this was done, we first note that Northpoint transmitters are located on the horizon relative to DBS receive antennas. Therefore, DBS receiver antenna sensitivity at the horizon is important.

In this plane, DBS antennas have two sensitive gain regions directed behind the antenna. These regions are caused by spillover from the antenna feed past the edge of the reflector. As shown in figure 2.1.4.1-1, these sensitive regions are identified as "spillover lobes," and are shown in the shape of "butterfly wings" when depicted in a polar plot of antenna gain sensitivity. These spillover lobes are located symmetrically off the back of the antenna beginning at about 48-degree angles from centerline. The gain values shown in Figure 2.1.4.1-1 come from measured data that was first published in the DIRECTV discussion on interference from terrestrial sources in 1994.

DBS Antenna Horizon Gain Characteristics



Physical Geometry | Horizon Gain Pattern (Typical)

Figure 2.1.4.1-1: DBS Receive Antenna Horizon Gain Sensitivity

When one of these sensitive regions is directed toward a Northpoint transmitter, there is a strong potential for interference.

For the Washington, D.C. demonstration, Northpoint elected to direct the main beam of their transmit antenna at an azimuth angle of 113 . Noting that the active DBS satellites serving the United States during the demonstration were located at 61.5°, 101°, and 119° West Longitude ("W.L."), interest quickly settled on two particular alignments for investigation. As can be seen in Figure 2.1.4.1-2, DBS earth stations located generally along an azimuth bearing of 108° from the Northpoint transmitter will have one of the two spillover lobes aimed at the transmitter. Similarly, DBS earth stations located generally along an azimuth bearing of 167° from the Northpoint transmitter will have one of the two spillover lobes aimed at the same transmitter. It is noted that victim DBS earth stations do not have to be located precisely along these azimuth bearing angles, but can suffer interference when in their general vicinity. Figures depicting the extent of these regions can be found in Sections 2.1.4.2 and 5.5.

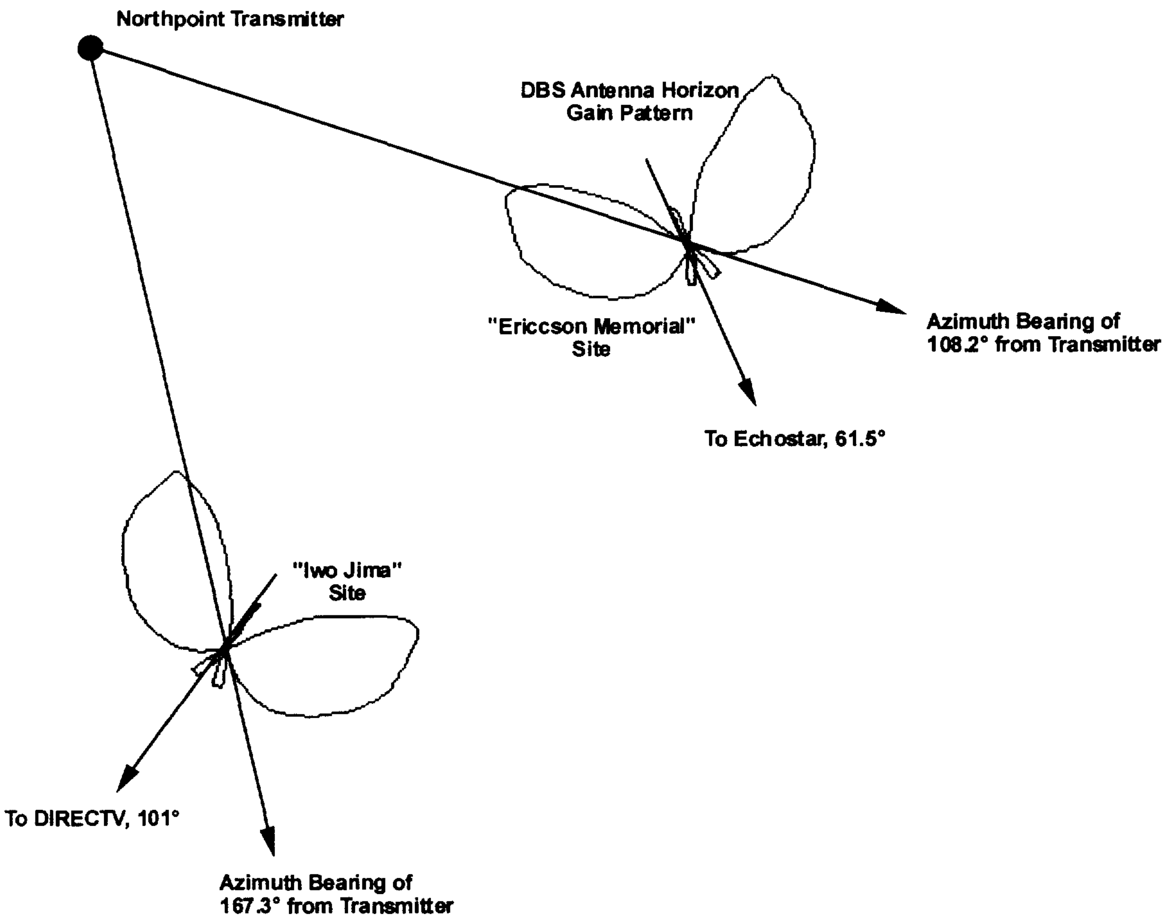


Figure 2.1.4.1-2: Washington, D.C. Demonstration Alignments of Interest

2.1.4.2 Measurement Results

DIRECTV made interference measurements along the 108° azimuth bearing at a site called "Ericsson Memorial/Polo Field." At this site, an *eight count drop* was recorded in the Echostar receiver signal meter, which corresponds to an approximate 84% increase in unavailability.[8] This is far, far in excess of the 10% increase in unavailability allowed for *all* NGSO-FSS systems. Note that the Northpoint transmit antenna peak gain azimuth had reportedly been set at 113°, quite close to the sensitive 108° bearing of interest.

DIRECTV made interference measurements along the 167° azimuth bearing at the "Iwo Jima Memorial" site. A three count decrease in a DIRECTV receiver signal meter reading was recorded with the Northpoint transmitter on. This means that a DBS receiver at this site would suffer a 15.4% increase in unavailability due to Northpoint interference. This is also higher than the interference that will be allowed from the aggregate of all NGSO-FSS systems.

These measurements by DIRECTV taken during the Northpoint Washington, D.C. demonstration clearly show unacceptable and harmful levels of interference into DBS receivers. Additional data taken by DIRECTV and by Northpoint at other sites also show interference levels above those allowed for single and multiple NGSO systems, and are discussed further in this report. Thus, the presence of unacceptable interference zones during the Washington demonstration has been shown conclusively.

2.1.4.3 Predicted Interference Levels

To generate predicted interference zones surrounding Northpoint transmitter sites, DIRECTV enlisted the help of Radio Dynamics, a respected engineering consulting firm.[9] This company, based in Bethesda, Maryland, performed propagation analysis of both the coverage areas and interference zones of Northpoint transmissions based on publicly available data. Radio Dynamics used the well-accepted OH Loss propagation model. Details on this analysis can be found in Section 6.

The results of this analysis are shown in Figure 2.1.4.3-1. The figure shows zones for interference into receivers looking at the Echostar satellite at 61.5° W.L. In this figure, the yellow area represents a predicted unavailability impact of 2.86 % on a DBS receiver, equivalent to the unavailability higher than that allowed by a single NGSO system. Green represents a predicted unavailability impact of 10% or greater on a DBS receiver, that is, an interference level above that of all NGSO-FSS systems combined.

Five sites (black dots) are also shown in the figure. These represent the approximate geographic location of some test sites where either DIRECTV or Northpoint took signal meter degradation readings. Selected signal meter

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[8] *See also* Echostar Satellite Corporation, *Preliminary Report on the Impact of Northpoint on the Direct Broadcast Satellite Service Based Upon Testing Performed to Date* (Oct. 29, 1999) ("Echostar Preliminary Report"), at 7.

[9] A description of the Radio Dynamics firm can be found at www.radyn.com.

degradation values taken by either DIRECTV or Northpoint were converted to an equivalent loss in unavailability performance. A direct comparison can then be made between the calculated amounts of degradation shown by the yellow and green areas and the selected field observations. (Note that this conversion for the Northpoint measured points is only an approximation since no calibration of their receivers' signal meters is available.)

The figure shows some reasonable correlation between the field data and the predictions, especially in the shape of the interference zone. However, some questions do remain. For example, the measured interference at Site 7 (Ericsson Memorial/Polo Field) was significantly higher than predicted.

Because DIRECTV did not have independent confirmation of Northpoint transmit power, true Northpoint antenna pointing angle and pattern, and other factors, it was not possible to draw firm conclusions on the true extent of the interference zones other than recognizing that the results confirm the predicted sensitive zones.

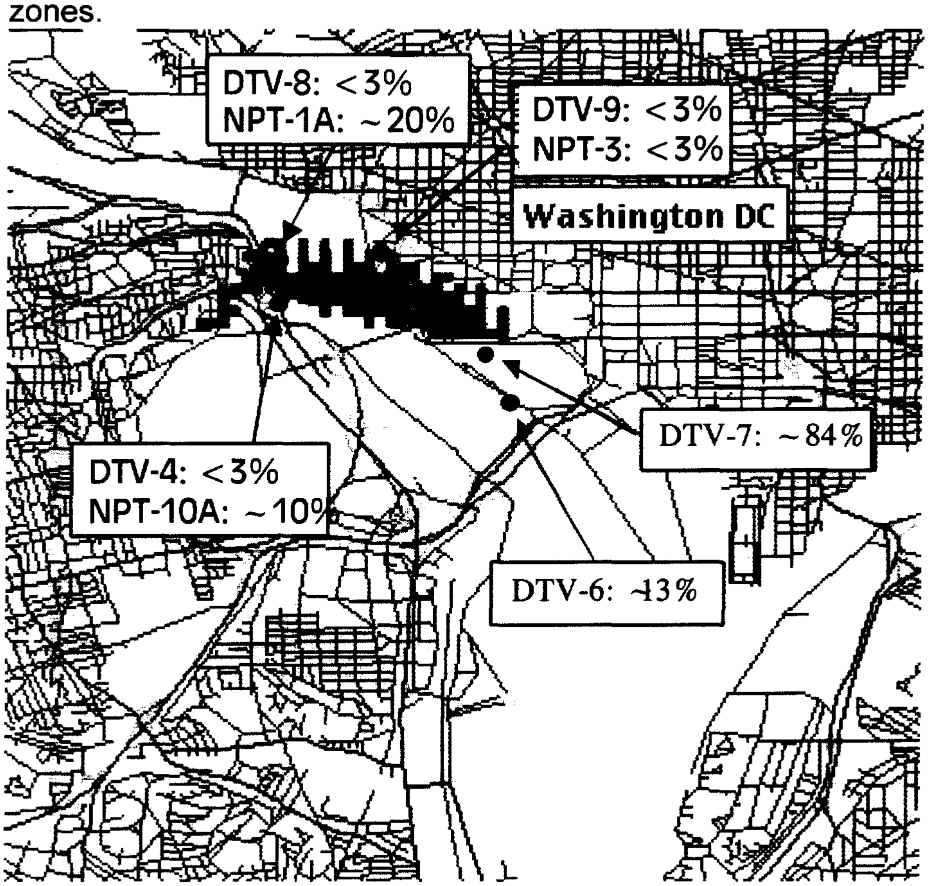

Figure 2.1.4.3-1: Predicted Interference, USA Today Site into Echostar / 61.5° W.L.

2.1.5 Generalization of Geometry to All DBS Orbital Slots

2.1.5.1 Must Protect Reception from All Possible BSS Assignments

It is critical the Commission recognize that every subscriber must be able to receive DBS signals from any provider. These providers can be located over a very wide range of the geostationary arc. The following table lists the currently assigned U.S. orbital positions, and foreign orbital positions from which transmissions to the U.S. may be allowed in the future:

Administration	**Assignments**, degrees West Longitude
United States	61.5, 101, 110, 119, 148, 157, 166, 175
Canada	82, 91
Mexico	69, 78, 127, 136
Argentina	94

Table 2.1.5.1-1: List of Potential BSS Assignments for U.S. Transmissions

In addition, it is important to recognize that assignments can be modified or added in the future through Plan modifications. Thus, with such a wide range of assignments and the possibility of future modified assignments, it is critical that reception from the entire geostationary arc (above some realistic minimum elevation angle) be protected.

2.1.5.2 Generalized Interference Zones

To generate generalized interference zones surrounding Northpoint transmitter sites, DIRECTV again enlisted the help of Radio Dynamics. One important output of this work was an analysis of the interference zones surrounding an example Northpoint transmitter located near Vienna, Virginia. This site was chosen as an illustrative site because it is approximately 16 kilometers due west of the USA Today site, and 16 kilometers is the typical proposed cell size of the Northpoint system. The results are shown in Figure 2.1.5.2-1.

The critical parameters in this analysis were set as follows:

- Northpoint antenna peak gain was oriented due south;
- DBS antenna horizon gain characteristics as shown in Fig. 2.1.4.1-1;
- interference power was analyzed for all assignments in Table 2.1.5.1-1;
- highest interference power was retained for each geographic point.

Thus, the figure represents an approximation of the size and shape of the interference zone surrounding a Northpoint transmitter when protecting reception from all potential DBS transmissions.

In the figure, yellow represents interference levels higher than that allowed for a single NGSO-FSS system, and green represents interference levels above that allowed for all NGSO-FSS systems combined. The yellow interference zone is approximately 5 kilometers in diameter. Given that the population density of adjacent Fairfax, Virginia is about 3,200 people per square mile, the population within the yellow interference zone is likely more than 20,000 people.

These interference zones are unacceptably large, and agree in principle with analysis previously provided by DIRECTV on this subject using different analytical tools.

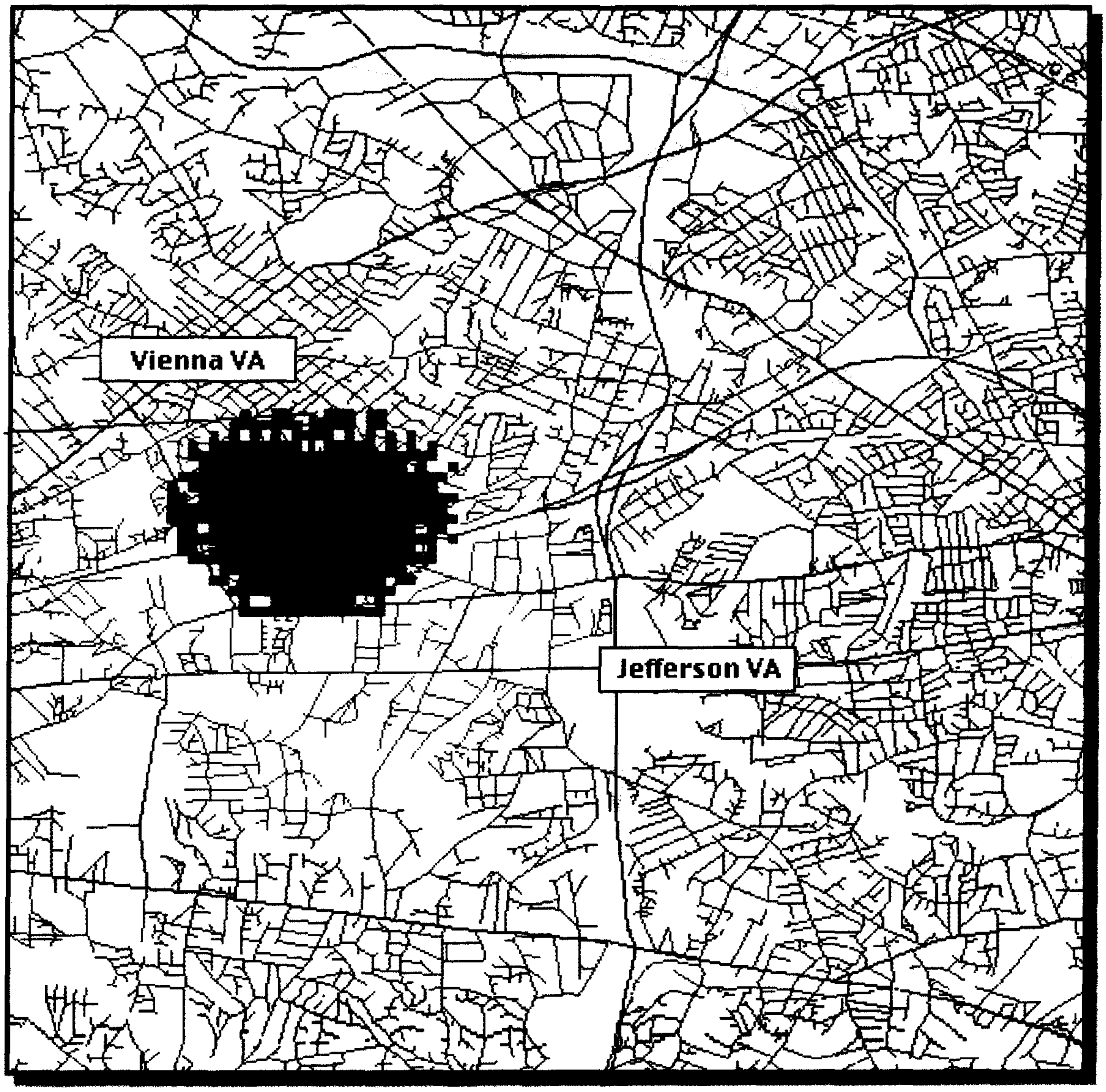

Figure 2.1.5.2-1: Interference Zones, Vienna VA Example

2.1.5.3 Coverage of a Metropolitan Area Would Lead to Multiple Interference Zones

To cover any reasonably sized metropolitan area, multiple Northpoint transmitters would need to be deployed. To better understand the impact, DIRECTV asked Radio Dynamics to analyze an array of Northpoint transmitters needed to cover a metropolitan area such as Washington, D.C.

This analysis assumed the following critical parameters:

- starting point was a transmitter located on the USA Today building;
- Northpoint antenna peak gain was oriented at an azimuth of 113°;
- Northpoint transmitters on a grid with 16 km spacing (as shown);
- DBS antenna horizon gain characteristics as shown in Fig. 2.1.4.1-1;
- interference power was analyzed for all assignments in Table 2.1.5.1-1; and
- highest interference power was retained for each geographic point.

Figure 2.1.5.3-1 shows the results of this analysis. Yellow and green are coded as before. Note the large interference zones surrounding the Northpoint transmitter sites, and the dramatic impact on residential areas surrounding the Washington, D.C. metropolitan area. The transmitter in the lower left of Figure 2.1.5.3-1 is at the same location as the transmitter in Figure 2.1.5.2-1 (Vienna, VA).

It is especially interesting to note here that every NGSO-FSS system must maintain interference levels below 'yellow' everywhere in this region, and that all NGSO-FSS systems combined must maintain interference levels below 'green' everywhere in this region.

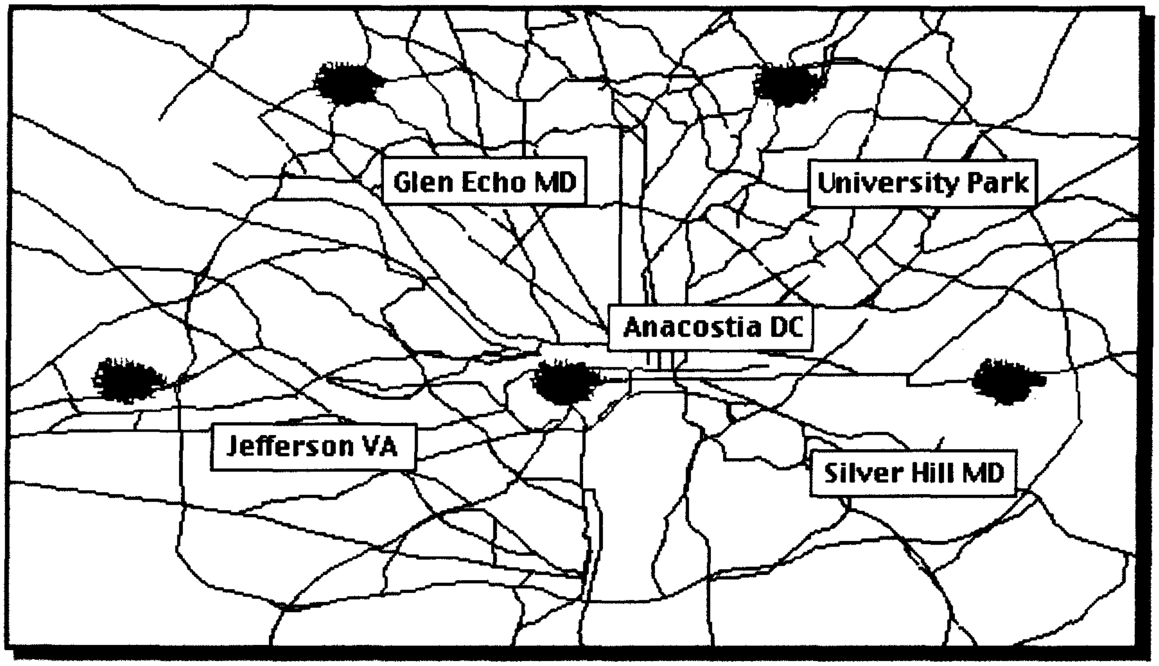

Figure 2.1.5.3-1: Impact of Multiple Northpoint Transmitters on Washington, D.C. Metropolitan Area

2.2 *Summary of Findings and Issues from the Washington, D.C. Demonstration*

The Washington, D.C. demonstration presumably was designed by Northpoint to put the best possible light on their system. Nevertheless, information was gathered that generally supports the interference analysis that has been provided by DIRECTV in this matter. When these results are generalized to more typical installations, the proposed Northpoint system emerges as a major source of interference to DBS operations.

While more detail regarding DIRECTV's observation of the Washington, D.C. tests is provided in Section 5, in general, the following conclusions can be drawn from the Northpoint Washington, D.C. demonstration and Northpoint system parameters:

- Added interference clearly degrades carrier quality and hence availability performance;

- Harmful interference was clearly seen in the Washington, D.C. demonstration at predicted bearing angles from the Northpoint transmitter;

- The observed interference levels at many of these sites were equal to or worse than DIRECTV predictions;

•These measurements show that, if anything, the DIRECTV generalized analysis of Northpoint interference zones may be understating their extent; and

• The extrapolation of the generalized analysis to coverage of a metropolitan area such as Washington, D.C. shows a dramatic and completely unacceptable impact to DBS service.

The following significant issues remain:

• The Washington, D.C. demonstration cannot be characterized as a typical installation, and further testing with better access to the interference zone is necessary;

• Northpoint's stated power levels, antenna pointing angles, transmit antenna pattern and tilt angle were never independently confirmed; as such, many data discrepancies could not be resolved;

• Any continued testing of availability performance in the presence of rain must be done on a long term basis with the use of a control receiver;

• Hilly terrain can add significant holes to the Northpoint coverage area; this implies added transmitters, which will clearly add more interference zones; and

• The signal availability and coverage of a Northpoint-engineered service has not been clearly demonstrated as a practical, competitive consumer offering.

Based upon the above, the Commission cannot allow such a system to be deployed. At a minimum, further controlled testing must be done using realistic deployment scenarios, and additional analysis must be performed in order to validate analytical models that would be useful in predicting high interference.

3 *Manifestation of Interference*

Received signal quality is of primary importance to a DBS operator delivering direct-to-home digital television programming. *Any increase* in the operational noise floor of a BSS receiver caused by the addition of interference will degrade DBS received signal quality. This addition of interference into DBS receivers manifests itself in two ways: (a) a complete loss of reception under clear-sky conditions; or (b) reduced availability of the signal under significant rain conditions.

The receiver signal meter can detect the addition of interfering noise to a received signal. Its operation is described in Section 3.1. Section 3.2 then describes the impact of interference on DBS system availability. Section 3.3

discusses the quasi-error free operating region and its relationship with rain fade events.

Results of a test designed to specifically demonstrate the effect of interference on DBS system availability is provided in Section 3.4.

3.1 *The Satellite Receiver Signal Meter Description*

DIRECTV used the signal meter extensively to detect changes in signal quality due to added interference during tests performed both in New York and Washington, D.C.. Although it is a device intended primarily to help consumers correctly aim their antenna at the DBS satellite, the signal meter is capable of detecting relatively small but significant changes in carrier-to-noise ("C/N") ratio. It is therefore important to understand how the satellite signal meter value is generated.

There are several different methods used by DBS receiver manufacturers to generate a signal to assist in antenna pointing. All of these techniques, however, generate a signal that is in direct proportion to received carrier-to-noise ratio.

The most commonly used method by DBS manufacturers to detect changes in received carrier-to-noise ratio is the signal quality estimation (SQE) technique, and is described below.

Figure 3.1-1 shows a simplified integrated receiver decoder (IRD) front end block diagram. A typical BSS system consists of an eighteen-inch reflector, low noise block down converter (LNB) and integrated receiver decoder. The reflector receives the satellite RF signal and routes it to the LNB. The LNB down converts the Ku-band signal to L band and routes it to the receiver. The receiver demodulates and decodes the necessary audio, video and data signals. The forward error correction block performs the function of correcting errors in the receiver for the desired information rate.

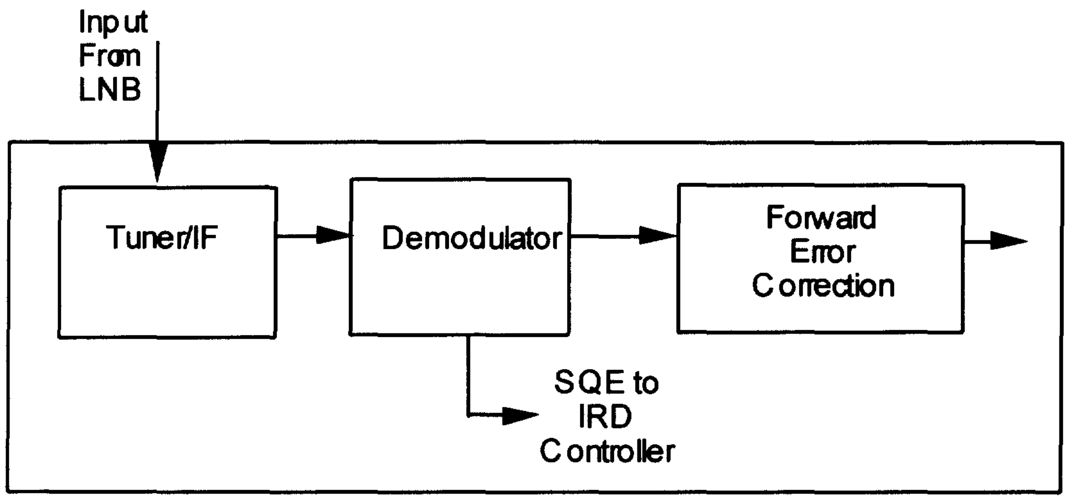

Figure 3.1-1: Top Level BSS Receiver Front End Block Diagram

In the SQE technique, an estimation of carrier-to-noise ratio is extracted from the demodulator prior to the forward error correction circuit. The SQE is calculated by comparing the incoming signal amplitude and phase to an idealized and sampled QPSK constellation of points as a function of power. A signal quality estimator index value is then generated and scaled from 0 to 100 to achieve the on-screen signal meter reading.

Thus, the signal meter detects changes in the received carrier-to-noise ratio. This meter can detect even small amounts of added noise when the receiver is receiving a strong satellite signal. This sensitivity can be seen in the calibration curve of a typical signal meter, as shown in Figure 3.1-2. This curve shows the relationship between signal meter values and C/N ratio. Depending on the location of the receiver and the transponder being viewed, a peaked satellite signal will result in signal meter values in the 80s to the 90s. Demodulator lock threshold is typically in the 20s or 30s depending on the information rate mode being used for the satellite transmission.

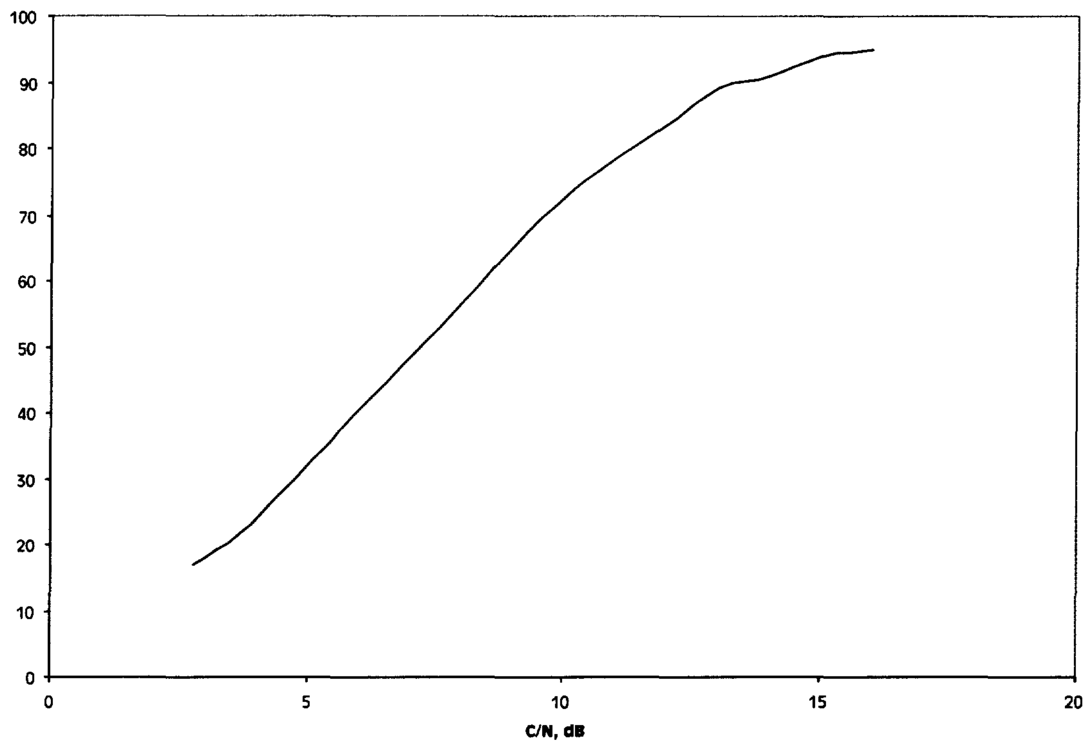

Figure 3.1-2: Typical BSS Receiver Signal Strength versus C/N Performance

It should be noted that for a given carrier-to-noise ratio, signal meter readings will vary some from receiver to receiver. This is more likely when comparing receivers from two different manufacturers. For use in these interference measurements, however, the point is not important. Once a given receiver has been calibrated with a spectrum analyzer to provide its particular relationship of C/N to signal meter counts, changes in the C/N ratio caused by added interference can be detected and measured. These changes can be converted into an equivalent C/I ratio corresponding to the added interference, and then the impact on unavailability can be calculated. This procedure was used for all receivers in DIRECTV's Washington, D.C. observations.

3.2 *How Interference Degrades C/N and Availability Performance*

Availability, or the percent of time at which a DBS signal is able to withstand rain fades, is a key discriminator of DBS service. This important element of service quality must be maintained and even improved if the DBS industry is to successfully compete with digital cable.

Availability performance is directly linked to received carrier-to-noise ratio. The higher the received carrier-to-noise ratio, the higher the so-called "clear-sky margin," and the better the system availability. The addition of interference